Docket No.: 0649-1178PUS1
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Kazumi NII et al.

Application No.: 10/560,735 Confirmation No.: 3722

Filed: December 15, 2005 Art Unit: 1794

For: ELECTROLUMINESCENT DEVICE Examiner: M. H. Wilson

DECLARATION UNDER 37 CFR 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Toshihiro ISE, declare and say as follows:

I am familiar with U.S. Application Serial No. 10/560,735, of which I am a co-inventor. I have reviewed all Office Actions issued in connection with this application. I have also reviewed all of the references cited by the Examiner in these Office Actions.

The following experiments were conducted either by myself or under my direct supervision. These experiments demonstrate that the present invention is superior and exhibits unexpected and advantageous properties over the prior art (e.g., Seo et al. (U.S. 2002/0086180) (hereinafter "Seo")). Specifically, the present invention exhibits superior external quantum efficiency and ease of operation, as compared to Seo.

A. **Experiments**

Example 1 (corresponding to Sample No. 104 in the Specification)

Copper phthalocyanine (CuPC) was deposited on a cleaned ITO substrate by vacuum evaporation to a thickness of 10 nm. α-NPD was vacuum deposited thereon to a thickness of 40 nm to form a hole transport layer. CBP (as a first host), BCP (as a second host), and Luminescent Material I-1 (see Enclosure) were vacuum co-deposited on the α-NPD layer at a deposition rate of 0.4 nm/sec, 0.1 nm/sec, and 0.03 nm/sec, respectively, to a total deposition thickness of 20 nm to form a light emitting layer. BCP and Alq were vacuum deposited thereon to a thickness of 10 nm and 40 nm, respectively, to form an electron transporting material. A pattern mask was put on the thus formed organic thin film, lithium fluoride was vacuum deposited, and aluminum was subsequently vacuum deposited to form a cathode. The resulting stack of layers was then sealed, and an EL device, having the configuration shown below, was obtained ("Inventive Device 104"):

ITO substrate/CuPc (10nm)/NPD (40 nm)/CBP+BCP+6%I-1 (20 nm)/BCP (10nm)/Alq (40nm)/LiF/Al.

The EL device was evaluated as follows. A constant direct current was applied to the device by use of Source-Measure Unit Model 2400 supplied by Toyo Corp. to cause the device to emit light. The luminance of the light was measured with a luminance meter BM-8 supplied by Topcon to obtain a luminescence efficiency. The emission wavelength was measured with Spectral Analyzer PMA-11 supplied by Hamamatsu Photonics K.K. The results are shown in Table 1.

Comparative Example 1

In Embodiment 11 of Seo, the light emitting material was replaced by phosphorescent material I-1. An EL device ("Comparative Device 1") was prepared by following a procedure as described above, except that the device configuration was as follows:

ITO substrate/CuPc (10nm)/NPD (40 nm)/NPD+CBP (15 nm)/NPD+CBP+6% I-1 (5nm)/CBP+BCP+6%I-1 (5nm)/CBP+BCP (5nm)/BCP (10nm)/Alq (40nm)/LiF/Al.

As in Embodiment 11 of Seo, there is a concentration gradient of the host materials in each layer of "NPD+CBP", "NPD+CBP+6%I-1", "CBP+BCP+6%I-1", and "CBP+BCP". The hole transporting materials in the hole transport layer "NPD+CBP" and the host materials in the light emitting layer "NPD+CBP+6%I-1" contacting the hole transport layer "NPD+CBP" are the same and, thus, no energy difference exists between the layers.

Comparative Example 2

In Embodiment 11 of Seo, the light emitting material was replaced by phosphorescent material I-1. An EL device ("Comparative Device 2") was prepared by following a procedure as described above, except that the device configuration was as follows:

ITO substrate/CuPc (10nm)/NPD (40 nm)/NPD+CBP+6% I-1 (10nm)/CBP+BCP+6% I-1 (10nm)/BCP (10nm)/Alq (40nm)/LiF/Al.

There is no concentration gradient in each layer. In this embodiment, the light emitting layer "CBP+BCP+6%I-1," which includes host materials having larger ionization potentials than

the hole transporting material in the hole transport layer "NPD," does not contact the hole transport layer "NPD."

The light emitting layer "CBP+BCP+6%I-1" includes two host materials different from the hole transporting material in the hole transport layer "NPD." However, this light emitting layer does not contact the hole transport layer, and thus, it is not possible to control the hole injection property in the device by taking advantage of an energy difference between the layers.

B. Results

Table 1

	External quantum Efficiency (%)	Number of workers who felt that operation was "complicated", out of 5 workers
Comparative Device 1	2.6%	5 workers
Comparative Device 2	2.5%	1 worker
Inventive Device 104	7.1%	0 workers

As shown by Table 1, Inventive Device 104 is superior in external quantum efficiency and has a less complicated manufacturing operation as compared to the comparative devices.

C. **Conclusion**

The present invention is superior and exhibits unexpected and advantageous properties over Seo.

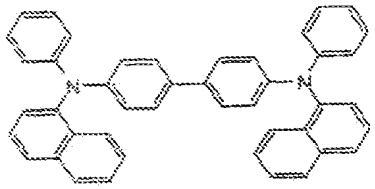
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Toshihiro Ise
Signature

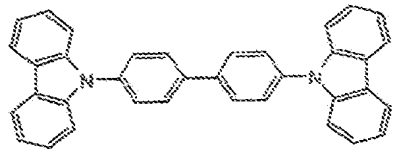
Toshihiro ISE
Typed or Printed Name

Feb. 4, 2010
Date

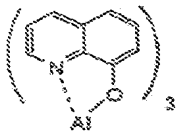
Enclosure: Chemical structures of materials employed



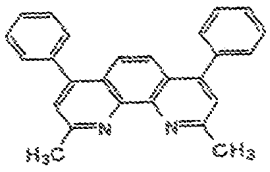
NPD



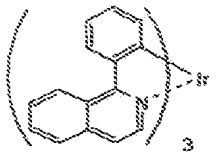
CBP



Alq



BCP



I-1